



**UNITED STATES ENVIRONMENTAL PROTECTION AGENCY**  
WASHINGTON, D.C. 20460

OFFICE OF  
PREVENTION, PESTICIDES  
AND TOXIC SUBSTANCES

**Note to Reader**

**Background:** As part of its effort to involve the public in the implementation of the Food Quality Protection Act of 1996 (FQPA), which is designed to ensure that the United States continues to have the safest and most abundant food supply. EPA is undertaking an effort to open public dockets on the organophosphate pesticides. These dockets will make available to all interested parties documents that were developed as part of the U.S. Environmental Protection Agency's process for making reregistration eligibility decisions and tolerance reassessments consistent with FQPA. The dockets include preliminary health assessments and, where available, ecological risk assessments conducted by EPA, rebuttals or corrections to the risk assessments submitted by chemical registrants, and the Agency's response to the registrants' submissions.

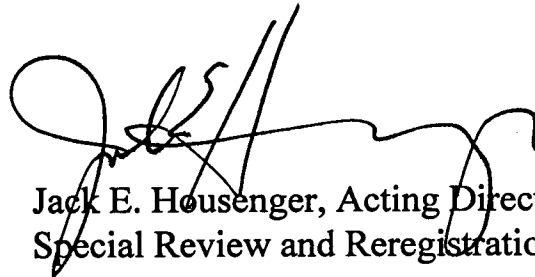
The analyses contained in this docket are preliminary in nature and represent the information available to EPA at the time they were prepared. Additional information may have been submitted to EPA which has not yet been incorporated into these analyses, and registrants or others may be developing relevant information. It's common and appropriate that new information and analyses will be used to revise and refine the evaluations contained in these dockets to make them more comprehensive and realistic. The Agency cautions against premature conclusions based on these preliminary assessments and against any use of information contained in these documents out of their full context. Throughout this process, If unacceptable risks are identified, EPA will act to reduce or eliminate the risks.

There is a 60 day comment period in which the public and all interested parties are invited to submit comments on the information in this docket. Comments should directly relate to this organophosphate and to the information and issues available in the information docket. Once the comment period closes, EPA will review all comments and revise the risk assessments, as necessary.

These preliminary risk assessments represent an early stage in the process by which EPA is evaluating the regulatory requirements applicable to existing pesticides. Through this opportunity for notice and comment, the Agency hopes to advance the openness and scientific soundness underpinning its decisions. This process is designed to assure that America continues to enjoy the safest and most abundant food supply. Through implementation of EPA's tolerance reassessment program under the Food Quality Protection Act, the food supply will become even safer. Leading health experts recommend that all people eat a wide variety of foods, including at least five servings of fruits and vegetables a day.

**Note:** This sheet is provided to help the reader understand how refined and developed the pesticide file is as of the date prepared, what if any changes have occurred recently, and what new information, if any, is expected to be included in the analysis before decisions are made. **It is not meant to be a summary of all current information regarding the chemical.** Rather, the sheet provides some context to better understand the substantive material in the docket ( RED chapters, registrant rebuttals, Agency responses to rebuttals, etc.) for this pesticide.

Further, in some cases, differences may be noted between the RED chapters and the Agency's comprehensive reports on the hazard identification information and safety factors for all organophosphates. In these cases, information in the comprehensive reports is the most current and will, barring the submission of more data that the Agency finds useful, be used in the risk assessments.

A handwritten signature in black ink, appearing to read 'J. Housenger', is written over the typed name and title.

Jack E. Housenger, Acting Director  
Special Review and Reregistration Division

**MEMORANDUM:** October 6, 1999

**SUBJECT:** EFED's concerns over well contamination associated with termiticide use and EFED recommended concentrations for HED drinking water assessment of chlorpyrifos

**TO:** Deborah Smegal  
Health Effects Division  
Office of Pesticide Programs

Mark Hartman, Chlorpyrifos Product Manager  
Special Review and Reregistration Division  
Office of Pesticide Programs

**FROM:** Henry Nelson, Ph.D., Chemist  
Environmental Risk Branch III  
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**THROUGH:** Daniel Rieder, Chief  
Environmental Risk Branch III  
Environmental Fate and Effects Division/OPP

One of the primary purposes of this memo is to revise EFED's recommendations to HED concerning the ground and surface water concentrations of chlorpyrifos to be used by HED in its preliminary risk assessment. However, the well contamination associated with the termiticide use of chlorpyrifos is discussed first to reflect EFED's substantial concerns about it.

### **Concerns Over Well Contamination Associated With Termiticide Use**

In Appendix D of the Dow response to the HED preliminary human risk assessment, Dow argues that the contamination of wells associated with termiticide use should be treated as preferential flow related isolated accidents that require remediation, not as exposure scenarios to be considered in regulating legal uses of chlorpyrifos. However, most reported incidents of well contamination by chlorpyrifos are associated with its legal use as a termiticide. Furthermore, it is unclear how infrequent such well contamination occurs. Dow depends on the homeowner to notify them of any well contamination associated with the termiticide use of chlorpyrifos, but the homeowner generally does not suspect there is any contamination unless the ground water exhibits an unusual smell or appearance. Dow's response does not include a comparison of chlorpyrifos concentrations required to cause ground water to exhibit an abnormal smell or appearance to those concentrations necessary to potentially cause an adverse health affect on people drinking from the wells. In the likely event that the smell and/or visual thresholds are

substantially higher than the potentially toxic thresholds, many more wells than have been reported could have been contaminated to levels potentially hazardous to the consumers without them realizing and reporting it. In addition, in some areas of the United States such as Karst areas, substantial preferential flow to ground water frequently occurs.

If smell and/or visual thresholds are substantially higher than toxic thresholds for chlorpyrifos, monitoring of wells for chlorpyrifos in the vicinity of its termiticide use should be required. In addition, the State of Illinois and Region 5 of the U.S. EPA have expressed concern over the substantial formation of chlorpyrifos oxon in wells treated for chlorpyrifos contamination. Because the oxon may also exert substantial toxicity, wells treated for chlorpyrifos contamination should also be monitored for the oxon as well as chlorpyrifos. In addition, a level of concern (LOC) for the oxon in drinking water should be developed.

Finally, in the current remediation program, Dow recommends that people can resume the use of wells treated for chlorpyrifos contamination when the chlorpyrifos concentration falls below 30 ug/L. However, HED has indicated that the level of concern (LOC) for chlorpyrifos in drinking water is much closer to 1 ug/L than to 30 ug/L. Therefore, the recommended chlorpyrifos level below which wells are considered to be safe to use again should be lowered from the current 30 ug/L. In addition, the level of the oxon may also have to be considered in determining whether it is safe to start using a treated well again.

#### **EFED Recommended Ground and Surface Water Concentrations to HED (for Use in Their Preliminary Risk Assessment)**

In a memo dated November 20, 1998 from Mike Barrett of EFED to Steve Knizner of HED, EFED recommended to HED (for use in their chlorpyrifos drinking water risk assessment) dissolved concentrations of chlorpyrifos and TCP in ground and surface water. In response to the July 23, 1999 HED preliminary risk assessment for chlorpyrifos, Dow recommended alternate dissolved concentrations of chlorpyrifos for the drinking water assessment.

In the following Table 1, the dissolved concentrations of chlorpyrifos originally recommended by EFED are provided along with those that Dow is recommending and the revised EFED recommendations. Refer to the footnotes for the discussion.

(See next page)

**Table 1:** Original EFED, Dow, and revised EFED recommendations of ground and surface concentrations for HED’s estimates of upper acute and chronic risks associated with chlorpyrifos contaminated drinking water. The discussion is provided in the footnotes.

<b>Drinking Water Source</b>	<b>Exposure Duration</b>	<b>Original EFED Recommendation (ug/L)</b>	<b>Dow Recommendation (ug/L)</b>	<b>EFED Revised Recommendation (ug/L)</b>
<b>Ground Water (except for termiticide use)</b>	acute or chronic	0.1 <sup>1</sup>	0.01 <sup>1</sup>	0.007 to 0.103 <sup>1</sup>
<b>Ground Water for termiticide use</b>	acute	2000 <sup>2</sup>	30 <sup>2</sup>	30 to 2090 <sup>2</sup>
<b>Ground Water for termiticide use</b>	chronic	2000 <sup>3</sup>	0.1 <sup>3</sup>	8.3 to 578 <sup>3</sup>
<b>Surface Water</b>	acute	0.4 <sup>4</sup>	0.4 <sup>4</sup>	0.026 to 0.4 <sup>4</sup>
<b>Surface Water</b>	chronic	0.4 <sup>5</sup>	0.06 <sup>5</sup>	0.026 to 0.4 <sup>5</sup>

**Footnote # (1):** The dissolved concentration of chlorpyrifos in ground water that EFED originally recommended to HED for estimating upper acute and chronic risks associated with non-termiticide uses was 0.1 ug/L. That value was the result of a SCIGROW run for sweet corn based on a total application = (11 apps)(1 lb ai/acre/app) = 11 lbs ai/acre, an assumed aerobic soil metabolism half-life of 63 days, and an assumed K<sub>oc</sub> of 6070.

Dow indicated that use on sweet corn constituted only a “minute fraction of total chlorpyrifos use”. The dissolved concentration of chlorpyrifos in ground water that Dow is recommending to HED for estimating upper acute and chronic risks associated with non-termiticide uses is 0.01 ug/L. That value is the result of a SCIGROW simulation for corn based on a single application of 1.2 lbs ai/acre, an assumed aerobic soil metabolism half-life of 30 days, and an assumed K<sub>oc</sub> of 6070.

EFED Recommendations (Footnote #1):

EFED recommends that a 0.007 ug/L to 0.103 ug/L range of SCIGROW estimated dissolved concentrations of chlorpyrifos in ground water be used by HED for estimating upper acute and chronic risks associated with non-termiticide uses. The recommended range of SCIGROW estimated dissolved concentrations of chlorpyrifos in ground water are shown in the following

Table 2. The estimates are based upon typical and maximum total applications for various major crops as shown in the following table. The 4 crops listed in the table represent the greatest percentages of the total agricultural use of chlorpyrifos as shown in parentheses. However, a review of application rates for other agricultural uses indicate that almost all lay within the range of those for the major crops.

In all cases but citrus, the “typical” total application was provided by Dow. In all cases, the “maximum” total application were those previously used by EFED in modeling.

Based on an expanded data set and the latest EFED recommendations for developing input to SCIGROW, EFED used an average chlorpyrifos soil metabolism half-life of 28.7 days (based on 41 values) and a median  $K_{oc}$  value of 5600 (based on 27 values) in all of the revised EFED SCIGROW runs..

**Table 2:** SCIGROW estimates of dissolved concentrations in ground water associated with various major agricultural uses of chlorpyrifos.

<b>Crop (% of total agricultural use)</b>	<b>Typical Total App. (lbs ai/ac)</b>	<b>Typical SCIGROW Conc. (ug/L)</b>	<b>Maximum Total App. (lbs ai/ac)</b>	<b>Max. SCIGR. Conc. (ug/L)</b>
<b>Corn (55%)</b>	1 x 1.2 = 1.2	0.011	11 x 1 = 11 1 x 3; 2 x 1.5 = 3 1 x 2 = 2 1 x 1.5 = 1.5	0.103 0.028 0.019 0.014
<b>Cotton (6.8%)</b>	1.7 x 0.7 = 1.2	0.011	6 x 1 = 6	0.056
<b>Alfafa (5.9%)</b>	1 x 0.7 = 0.7	0.007	4 x 1 = 4	0.037
<b>Citrus (5.8%)</b>	1 x 2.4 = 2.4	0.022	2 x 3.5 = 7	0.065

Note that the range of SCIGROW estimated dissolved concentrations of chlorpyrifos in ground water in the above table (0.007 ug/L to 0.103 ug/L) is comparable to the range formed from the Dow recommended and original EFED recommended values (0.01 ug/L to 0.1 ug/L).

During the first phase of the NAWQA study, the USGS analyzed 3023 filtered ground water samples for chlorpyrifos. The samples were collected for a several year period during the early to mid-90s from 20 study areas throughout the U.S. The maximum reported chlorpyrifos concentration in filtered groundwater samples (reflecting approximate dissolved concentration) in the NAWQA study was 0.026 ug/L.

The maximum SCIGROW estimated dissolved concentration of chlorpyrifos in ground water of 0.103 ug/L is approximately 4 times the maximum concentration of 0.026 ug/L reported for chlorpyrifos in filtered ground water samples collected during the first phase of the NAWQA study. However, 0.026 ug/L does lay within the range of SCIGROW estimates from 0.007 ug/L to 0.103 ug/L. Furthermore, although some of the 20 study areas in the first phase of the NAWQA study overlap areas of substantial chlorpyrifos use, the NAWQA study is not a chlorpyrifos specific study designed to determine peak dissolved concentrations of chlorpyrifos in ground water. Therefore, EFED recommends that until more chlorpyrifos ground water data are collected, HED use the range of SCIGROW estimates of dissolved concentrations of chlorpyrifos in ground water in estimating upper acute and chronic risks associated with non-termiticide use.

In using the SCIGROW estimated concentrations of chlorpyrifos in ground water, HED should acknowledge that they are probably conservative for most ground waters. HED should also indicate that despite the overlap of some of the first phase NAWQA 20 study units with areas of substantial chlorpyrifos use:

- (a) The maximum reported ground water concentration of chlorpyrifos in the first phase of the NAWQA study was only 0.026 ug/L.
- (b) The 95<sup>th</sup> percentile was below the detection limit of 0.004 ug/L
- (c) Chlorpyrifos was only detected in 0.3% of the 3023 samples analyzed.

**Footnote # (2):** The dissolved concentration of chlorpyrifos in ground water that EFED originally recommended to HED for estimating upper acute risks associated with termiticide use was 2000 ug/L. That value is the approximate highest reported dissolved concentration of chlorpyrifos in a well contaminated as the result of the termiticide use (the actual highest value was 2090 ug/L).

The dissolved concentration of chlorpyrifos in ground water that Dow is recommending to HED for estimating upper acute risks associated with termiticide use is 30 ug/L. That value is the level below which Dow recommends (in their voluntary stewardship program) resuming the use of a well whose use had been suspended, and that had been treated as the result of chlorpyrifos contamination due to termiticide use.

EFED Recommendations (Footnote #2):

EFED recommends that a 30 ug/L to 2090 ug/L range of dissolved chlorpyrifos concentration in ground water be used by HED for estimating a range of upper acute risks associated with termiticide use. The 30 ug/L value would only be applicable in cases where the contaminated well was identified immediately after contamination, the well was removed from use, and was not used again until chlorpyrifos levels declined below the 30 ug/L level. In other highly contaminated wells, acute exposure concentrations would be higher. Although 2090 ug/L was the maximum reported value in wells contaminated by the termiticide use, it use as the upper bound of the range

is justified because other reported values maximum values in Table 11 of the November 20, 1998 EFED memo (1644 ug/L, 916 ug/L) indicate that 2090 ug/L is not an extreme outlier.

**Footnote # (3):** The dissolved concentration of chlorpyrifos in ground water that EFED originally recommended to HED for estimating upper chronic risks associated with termiticide uses was also 2000 ug/L. Again, that value is the approximate highest reported concentration of chlorpyrifos in a well contaminated as the result of the termiticide use (the actual highest value was 2090 ug/L).

The dissolved concentration of chlorpyrifos in ground water that Dow is recommending to HED for estimating upper chronic risks associated with termiticide uses is 0.1 ug/L. That value is the reported detection limit for chlorpyrifos in well water for the monitoring component of Dow's voluntary stewardship program.

EFED Recommendations (Footnote #3):

The use of the Dow recommended 0.1 ug/L for the upper estimate of chronic risks associated with the termiticide use is not advisable or justified. The reason is because in cases where there is substantial contamination of wells by chlorpyrifos due to termiticide use, it may take anywhere from 1 week to over 6 months for the dissolved chlorpyrifos concentrations to decrease from the maximum initial concentration to a concentration less than the detection limit (see Table 11 of the November 20, 1998 EFED memo). Therefore, the average annual dissolved concentration in highly contaminated wells should generally be substantially greater than the detection limit of 0.1 ug/L. In addition, the factors that determine the annual average concentration in a contaminated well such as the magnitude of the initial contamination and the dissipation rate in the well obviously do not include (nor are they in anyway affected by) the detection limit..

Although the average annual dissolved concentrations of chlorpyrifos in some wells contaminated due to termiticide use may be much greater than the detection limit of 0.1 ug/L, they will also generally be much less than the initial maximum concentrations reported due to abiotic hydrolysis and in some cases also due to substantial biodegradation. Therefore, the 30 ug/L to 2090 ug/L range of dissolved chlorpyrifos concentration in ground water recommended by EFED to HED for estimating upper levels of chronic as well as acute risks associated with termiticide use is probably too conservative for estimating the upper levels of chronic risk.

Although biodegradation may play an important role in decreasing chlorpyrifos concentrations in some wells, the low microbial activity in other wells may limit the contribution of biodegradation to the decrease in the chlorpyrifos concentration. Therefore, in attempting to arrive at more realistic but still somewhat conservative recommendations for groundwater concentrations to be used in the HED chronic assessments associated with termiticide use, EFED has chosen to use abiotic hydrolysis rates as follows:

Let  $C_0$  be equal to a ground water concentration used in the acute assessment (e.g., 2000 ug/L, 30

ug/L). The corresponding average annual concentration recommended for use in the chronic assessment would then be given by:

$$C = \frac{C_0 \int_0^{365} \exp(-k_{hydrolysis} t) dt}{365} = \left( \frac{C_0}{k_{hydrolysis} (365)} \right) \{1 - \exp[-(k_{hydrolysis})(365 \text{ days})]\}$$

where

$C_0$  = concentration used in the acute assessment (e.g., 2090 ug/L, 30 ug/L)

$C$  = corresponding concentration to be used in the chronic assessment

$k_{hydrolysis}$  = hydrolysis rate constant for chlorpyrifos at pH 7 =  $\ln 2 / 72.1 \text{ days} = 9.61 \times 10^{-3} \text{ 1/day}$

If 2090 ug/L is used as the upper bound of the range in the acute assessment, the corresponding concentration recommended for use as the upper bound in the chronic assessment would be the annual average concentration based on an initial concentration of 2090 ug/L::

$$C = \left( \frac{2090}{(9.61 \times 10^{-3})(365)} \right) \{1 - \exp[-(9.61 \times 10^{-3})(365)]\} = 578 \text{ ug / L}$$

If 30 ug/L is used as the lower bound of the range in the acute assessment, the corresponding concentration recommended for use as the lower bound in the chronic assessment would be the annual average concentration based on an initial concentration of 30 ug/L:

$$C = \left( \frac{30}{(9.61 \times 10^{-3})(365)} \right) \{1 - \exp[-(9.61 \times 10^{-3})(365)]\} = 8.3 \text{ ug / L}$$

Therefore, if a range of 30 ug/L to 2090 ug/L is used by HED to estimate upper acute risks associated with termiticide use, EFED recommends that a corresponding range of 8.3 ug/L to 578 ug/L be used to estimate upper chronic risks associated with termiticide use.

The above equations do not take into account additional dissipation of chlorpyrifos by ground water flow out of the well. If a conservative estimate of the ground water flow through the well ( $Q$ ) can be made, the above equations can be modified to reflect it by replacing  $k_{hydrolysis}$  with  $k_{hydrolysis} + Q$ .

**Footnote # (4):** The dissolved concentration of chlorpyrifos in surface water that EFED originally recommended to HED for estimating upper acute risks associated with non-termiticide uses was 0.4 ug/L. During the first phase of the NAWQA study, the USGS analyzed 5196 filtered surface water samples for chlorpyrifos. The samples were collected for a several year period during the early to mid-90s from 20 study areas throughout the U.S. The maximum reported chlorpyrifos concentration in filtered surface water samples (reflecting approximate dissolved concentration) in the NAWQA study was 0.4 ug/L. The 95<sup>th</sup> percentile was 0.026 ug/L.

Although Dow somewhat criticized the use of 0.4 ug/L in surface water for the acute assessment, they appear to have accepted it in their response to the HED preliminary risk assessment for chlorpyrifos.

EFED Recommendations (Footnote #4):

A number of the 20 study areas in the first phase of the NAWQA study overlap areas of substantial chlorpyrifos use. Consequently, EFED believes that the highest reported dissolved concentration of chlorpyrifos in surface water of 0.4 ug/L in the first phase of the NAWQA study is within the upper portion of the distribution of dissolved chlorpyrifos concentrations likely to be detected in flowing water and its use is therefore appropriate for the acute assessment.

However, HED should consider using a range of dissolved concentrations in surface water (bounded by the maximum reported value of 0.4 ug/L and the 95<sup>th</sup> percentile value of 0.026 ug/L) to estimate the upper acute risks associated with non-termiticide uses. Such actual concentrations probably much more closely approximate the upper range of dissolved chlorpyrifos concentrations in surface water source drinking water supplies than do the 11.1 ug/L to 40.6 ug/L range of PRZM/EXAMS estimated peak EECs for a 1 ha by 2 m deep pond draining a 100% cropped and 100% treated 10 ha field (see Table 6 in the November 20, 1998 EFED memo). However, see the caveat below.

The NAWQA study is not a chlorpyrifos specific study designed to capture maximum chlorpyrifos concentrations. Although a number of NAWQA study areas overlap areas of substantial chlorpyrifos use, others do not. In addition, many of the samples were collected at set time intervals instead of in response to runoff events (increased flow). Consequently, the maximum and 95<sup>th</sup> percentile dissolved chlorpyrifos concentrations in chlorpyrifos specific studies and in studies where most of the samples are collected in response to runoff events (increased flow) will probably be somewhat higher than those reflected by the NAWQA study.

That should be stated if HED uses the NAWQA values to estimate acute risks associated with non-termiticide uses.

**Footnote # (5):** The dissolved concentration of chlorpyrifos in surface water that EFED originally recommended to HED for estimating upper chronic risks associated with non-termiticide uses was

also 0.4 ug/L. The rationale, as presented in the November 20, 1998 EFED memo, is as follows.

Maximum reported dissolved pesticide concentrations are typically less in reservoirs than in flowing water. However, annual mean dissolved concentrations in reservoirs are typically somewhat higher than in flowing waters. Therefore it would not generally be appropriate to use annual averages in flowing water as surrogates for annual averages in reservoirs. Nevertheless, annual mean concentrations in reservoirs should not be any higher (and should generally be lower) than the peak concentrations in the flowing waters that feed them. Therefore, peak concentrations in flowing water can generally serve as conservative surrogates for annual mean concentrations in the reservoirs fed by the flowing water. Also, even though using 0.4 ug/L for the chronic assessment may be too conservative in some cases, some of the chlorpyrifos concentrations in chlorpyrifos specific studies (as previously indicated) could conceivably be higher than the 0.4 ug/L maximum reported value in the NAWQA study.

The dissolved concentration of chlorpyrifos in surface water that Dow is recommending to HED for estimating upper acute risks associated with non-termiticide uses is 0.06 ug/L based on two separate calculations that resulted in the same value:

(a) For the White River study unit in the NAWQA study (one that contains a substantial amount of chlorpyrifos use), Dow indicated that the maximum 68-day average dissolved concentration was 0.06 ug/L compared to a maximum reported concentration for that study unit of 0.13 ug/L. Applying the 0.06/0.13 ratio of 0.46 to the maximum reported dissolved concentration for the entire NAWQA study of 0.4 ug/L gives the following estimate of the maximum 68-day average for the NAWQA study across all of the 20 study units:  $(0.46)(0.4) = 0.18$  ug/L. Taking into account that chlorpyrifos concentrations outside the use on corn season will be much lower, Dow indicated that dividing the estimated maximum 68-day average dissolved concentration for the NAWQA study over all of the 20 study units by 3 would give a conservative estimate of the maximum annual average:  $(0.18/3) = 0.06$  ug/L

(b) Dow reported that the annual average dissolved concentration of chlorpyrifos in a California stream “receiving chlorpyrifos inputs during multiple application seasons” was 0.06 ug/L.

EFED Recommendations (Footnote #5):

Dow provides no documentation to indicate how the White River IN and Orestimba Creek CA data might compare to those from chlorpyrifos specific studies and/or studies that include a larger percentage of samples collected in response to runoff events. Also, EFED remains concerned about:

(a) The possibility that annual average dissolved concentrations in some reservoirs could be substantially higher than the annual average dissolved concentrations in flowing water.

(b) Dissolved concentrations in chlorpyrifos specific studies and/or in studies that have a large

number of samples collected in response to runoff events will probably be somewhat higher than in the first phase of the NAWQA study.

In their response to the Draft Chlorpyrifos EFED Chapter, Dow made the following rebuttal to EFED concern (a) above: “The trend for highest exposure levels to occur in small lakes and reservoirs is based on data for highly mobile, relatively persistent herbicide products. This trend has not been demonstrated for an insecticide such as chlorpyrifos, which is relatively non-persistent at agricultural use rates.”

There is no data cited by Dow to indicate that annual average dissolved concentrations of chlorpyrifos or similar insecticides in reservoirs are not higher than the annual average dissolved concentrations in the flowing waters that feed them. In addition, much of the dissipation observed for dissolved chlorpyrifos in fate studies appears to be due to adsorption to suspended and bottom sediment and possibly volatilization, not degradation. Therefore, chlorpyrifos could be somewhat persistent in deep reservoirs with low suspended sediment and low microbial activity.

Because of the EFED concerns described above, EFED recommends that for now, HED use the same range of dissolved chlorpyrifos concentrations in surface water for estimating upper chronic risks associated with non-termiticide uses as is being recommended by EFED for estimating upper acute risks (0.026 ug/L to 0.4 ug/L - see footnote #4). Such values are probably conservative for most surface waters. However, the available monitoring data indicate they are probably much closer to upper bound average concentrations in drinking water than the 1.9 ug/L to 6.7 ug/L range of PRZM/EXAMS estimated 90-day average EECs for a 1 ha by 2 m deep pond draining a 100% cropped and 100% treated 10 ha field (see Table 6 in the November 20, 1998 EFED memo).

### **Monitoring Data Summary in Appendix D of the Dow Response to the Preliminary HED Risk Assessment**

In addition to discussing well contamination associated with the termiticide use of chlorpyrifos, the Dow Appendix D summarizes a recent literature survey of chlorpyrifos in ground and surface water for the period 1990-1997 by Christensen and Dando (1999). The summary provided is as follows:

“No detections were reported for chlorpyrifos in 4,267 SDWA samples. In the STORET drinking water database, there are no detections in 99 samples analyzed for chlorpyrifos. USGS NAWQA monitored 33,482 non-drinking water samples in 20 NAWQA Study Units. Detections for chlorpyrifos totaled 1,177 (3.5%), and the maximum detected concentration was 0.4 ug/L. The STORET non-drinking water database for the five OP insecticides in the study contains 19,842 samples collected from 41 states, Guam, the Northern Mariana Islands, and Puerto Rico. There were 228 detections reported for chlorpyrifos, and the maximum concentration was 1.7 ug/L. State agency data from 10 states aggregated to 26,713 non-drinking water monitoring studies for

the five OP insecticides in the study. There were 253 reported detections for chlorpyrifos, and the maximum concentration was 3.7 ug/L. The literature search captured 7,262 monitoring samples for the five OP insecticides in the study. All detections occurred only in surface water. There were 98 chlorpyrifos detections, and the maximum concentration was 0.15 ug/L.”

EFED has not as yet received the Christensen and Dando (1999) literature review so it was not possible to obtain additional information from it such as percentiles or types of samples (ground versus surface water). However, it will be considered along with other additional monitoring data in generating recommended concentrations for the final HED assessment.